Purpose/Objective: The CyberKnife® Robotic Radiosurgery System uses two x-ray sources to set up patient, to track region of interest and to correct patient's position. The aim of this study is to evaluate the number of images per one fraction and to calculate the imaging dose for the whole treatment for different localizations.

Materials and Methods: A retrospective analysis was performed on a group of 20 patients treated with CyberKnife® system. The group included 10 patients with brain tumors and 10 patients with prostate cancer. The used x-ray parameters were similar within considered localization and it was respectively 120 kV, 100 mA and 100 ms for prostate and 115 kV, 100 mA and 100 ms for brain. The interval between images taken during the fraction was specified by physician at the first fraction of the treatment and it was 60 s for all patients. Typical amount of beams ranged from 148 to 177 for prostate and from 67 to 203 for brain. The number of fractions and the fraction dose for each localization was respectively: 5 fractions and 7.25 Gy for prostate and 3 fractions and 6 Gy for brain. To calculate the mean number of images per one fraction the whole information about the imaging (such as: number of images taken during the positioning, final number of images per fraction, image interval and x-ray parameters) for each fraction was saved. Based on our results and publications data, the surface dose from imaging system, which received patients with brain tumors and prostate cancer, was calculated.

Results: The study found that the mean number of acquired images per one fraction for each localization was: 77 for prostate and 105 for brain. The calculated surface dose was 18.48 mGy per fraction for prostate case and 10.87 mGy per fraction for brain. Total dose from images taken during the whole treatment course was 92.4 mGy for prostate cancer and 32,61 mGy for brain tumors.

Conclusions: The number of images and the dose on the surface is different for each localization. We suspect, that the higher number of images and higher dose from imaging system for prostate cancer results from the number of fractions and from movements of prostate gland (which forced us to make some additional images during the positioning and during the time of irradiation) as well.

EP-1663

Breast cancer patient interfraction displacement assessment before and after on-line CBCT corrections in IMRT

J. Li[1], W.A.N.G. Wei[1], X.U. Min[1], S.H.A.O. Qian[1], Z. Yingjie[1]
[1]*Shandong Cancer Hospital, Department of Radiation Oncology, Jinan, China*

Purpose/Objective: To model interfraction motion variation in breast cancer patients with intensity modulated radiotherapy (IMRT) based on cone beam CT (CBCT), and to quantify interfraction motion in patients with breast cancer.

Materials and Methods: Eighteen breast cancer patients after breast conserving surgery underwent whole breast IMRT were included in this study. A total of 452 CBCT scans were acquired. Three dimensional interfraction motion and setup error before and after on-line CBCT-based corrections were quantified. Trends in magnitudes of interfraction motion were assessed during treatment.

Results: Magnitude the interfraction displacements varied widely among the 18 patients, and for the same patient, the displacement among three dimensional directions were also different. The largest interfraction variability in the lateral (LR)?anteroposterior (AP) and superoinferior (SI) direction were 0.22cm?0.49cm?0.48cm prior to CBCT-based corrections, and 0.16cm?0.21cm?0.17cm after on-line CBCT-based corrections. On-line CBCT-based corrections decreased the displacement in SI direction (-0.08 cm vs 0.03 cm, t=-2.373,P=0.034) and random error (σ), but there were no significant differences for systematic error (Σ). No trends in interfraction motion were observed before and after on-line CBCT-based corrections.

Conclusions: For breast cancer patients underwent IMRT, both interfraction displacement in SI direction and mean population random error were reduced after on-line CBCT-based corrections using automated greyscale match. As a result of individual differences,although slight progressive changes occur in all directions with the increasing of treatment times, no significant trend was identified before and after on-line CBCT-based corrections.

EP-1664

Radiotherapy treatment verification in a cohort of limb sarcoma patients: an audit of departmental practice

S. Petkar[1], S. Moinuddin[1], H. Grimes[2], S. Nash[3], F. Le Grange[1], B. Seddon[1]
[1]*University College London Hospital, Radiotherapy, London, United Kingdom*
[2]*University College London Hospital, Radiotherapy Physics, London, United Kingdom*
[3]*University College London, CR UK and UCL Cancer Trials Centre, London, United Kingdom*

Purpose/Objective: Regular set up audits facilitate the calculation of departmental margins and inform the action level and frequency of the IGRT required. They should be carried out whenever changes in the patient pathway are proposed and become even more important when changing from conformal delivery to IMRT with potential reduction in margins (1). We present the set up data acquired by using an in-house bespoke immobilisation system for our limb sarcoma patients.

Materials and Methods: A retrospective audit was undertaken using limb sarcoma patients treated in the period 2012-2014. Patients who had sarcomas in the thigh region were selected as these were the majority of limb cases, using the same customised immobilisation. Patients were further categorised by gender, laterality, pre- or post-operative radiotherapy, and to which joint (knee or hip) was used for verification. Aria 11.0 (Varian Medical Systems) was reviewed to extract orthogonal kilovoltage (kV) (and megavoltage) imaging data taken for each patient for each imaging session. Patients were imaged in the first three days of treatment and the systematic error was then calculated in longitudinal, vertical and lateral directions. The set-up was then adjusted for all of the following sessions. An image was additionally acquired on session 4 and then weekly to ensure random set up error was within tolerance. Population mean, systematic and random errors were calculated for measurements in each direction. Margins were suggested based on these data (2).

Results: Thirty-four patients were treated in the selected time period, 15 male and 19 female, and 13 right limbs and 21 left limbs. Radiotherapy was delivered pre-operatively in 18 cases and post-operatively in 16 cases. In 20 cases, localisation was performed to the pelvis, 12 cases to the knee joint and 2 cases to the shaft of the femur. The mean population error in the vertical, longitudinal, and lateral directions was 0.3mm, 0.2mm and -0.3 mm respectively. Systematic and random errors for these directions were calculated to be 1.6(2.4) mm, 1.4(2.2) mm and 1.0(2.5) mm respectively. These data resulted in calculated margins in the vertical, longitudinal and lateral directions of 5.6mm, 5.1mm and 4.3mm respectively.

Conclusions: These data show that our customised immobilisation system and imaging protocol provide a set-up reproducibility covered by the margins typically used (5-7mm). Although margin reduction could be facilitated, there are limitations of this audit. Firstly, the limitations of the kV imaging length results in only one end of the limb being imaged and therefore the effect of rotation cannot be seen at the other end. Secondly, since direct visualisation of the soft tissue target is not possible with kV imaging, planning target volume (PTV) coverage is only assumed. The advent of extended length cone beam CT will enable direct visualisation of PTV, the entire extent of the femur, and other organs at risks e.g. external genitalia.

EP-1665

Do radiotherapy tattoos reliably guide patient set up for breast tumour bed treatment? - A review of current practice

S. Chauhan[1], J. Stratford[1], I. Patel[2], H. Lander[3], C. Anandadas[3], J. Loncaster[3]

[1]*The Christie NHS Foundation Trust, Wade Centre for Radiotherapy Related Research, Manchester, United Kingdom*

[2]*The Christie NHS Foundation Trust, Christie Medical Physics and Engineering, Manchester, United Kingdom*

[3]*The Christie NHS Foundation Trust, Clinical Oncology, Manchester, United Kingdom*

Purpose/Objective: The introduction of a national trial where the whole breast, partial breast and tumour bed are concurrently treated using photon radiotherapy and verified using daily online Cone Beam CT (CBCT) imaging, has enabled this institution to gather 3D set up data in regards to breast tumour bed coverage. The tumour bed Clinical Target Volume (CTV) is expanded by 0.5cm in 3-dimensions to create the tumour bed Planning Target Volume (PTV). Treatment will only be delivered when the tumour bed is within 0.2cm of the planned position.

Breast patients were immobilised with both arms above head using the Q-Qual™ board. During patient set up, alignment of the lateral and anterior radiotherapy tattoos was achieved. All planned isocentric shifts were executed to determine the L-R, S-I and the initial A-P treatment position. A further A-P adjustment may be required dependant on the planned concurrent tangential beam entry point in relation to the radiotherapy tattoos. This review aims to evaluate the reliability of using radiotherapy tattoos for breast patient set up in relation to breast tumour bed coverage for trial patients at this institution.

Materials and Methods: Imaging data for trial breast patients receiving 3D-CBCT guided radiotherapy, treated between January 2014 and October 2014, was retrospectively analysed within Elekta Synergy ™-version 4.5.

The frequency of set-up corrective action greater than 0.2cm in response to 3D-CBCT imaging and associated treatment margins were determined.

Results: Data for 135 treatment sessions of 9 patients was analysed. 85% of sessions required set-up correction greater than 0.2cm in at least one direction; 56% (76/135) of moves were required in the L-R direction, 46% (62/135) in the S-I direction and 54% (73/135) in the A-P direction (with an average magnitude shift of 0.32cm, 0.31cm and 0.34cm respectively).

The required CTV-PTV margin for the tumour bed, based on uncorrected and corrected data, is shown in table 1.

Table 1 - Required Breast Tumour Bed PTV margin, based on uncorrected and corrected data

Radiotherapy tattoo guided patient set-up –v- CBCT guided set up (Breast tumour bed)	Translational plane		
Radiotherapy Tattoo guided patient set up	L-R / cm	S-I / cm	A-P / cm
Random error	0.15	0.17	0.20
Systematic error	0.2	0.16	0.19
PTV margin - Van Herk margin recipe	**0.6**	**0.53**	**0.63**
CBCT guided patient set up			
Random error	0.04	0.05	0.05
Systematic error	0.01	0.02	0.01
PTV margin - Van Herk margin recipe	**0.05**	**0.08**	**0.07**

Conclusions: Treatment accuracy within 0.2cm in any translational plane will only be achieved in 15% of trial breast tumour bed treatments where set up is guided using radiotherapy tattoos alone. However, using radiotherapy tattoos in conjunction with 3D-CBCT image guidance will ensure accurate tumour bed coverage using the current 0.5cm CTV-PTV expansion of the breast tumour bed. The local practice of ensuring tumour bed coverage is within 0.2cm in any given translational plane prior to treatment delivery does imply that a CTV-PTV margin of less than 0.5cm could be applied for this trial. However, margin reduction should be applied with caution, as delineation and intra-fractional variation has not been measured.

EP-1666

Validation of a method for selecting patients for daily image and online evaluation in head and neck cancer treatments

N. Espinosa[1], A. Coral[1], M. Vargas[1], C. Diaz[1], J. Cabezali[1], F. Suriñach[1], E. Arroyo[1], V. Rosas[1]

[1]*Hospital de la Santa Creu i Sant Pau, Department of Radiation Oncology, Barcelona, Spain*

Purpose/Objective: Our center is using NAL3 plus weekly imaging as Image Guidance protocols for 3DCRT and IMRT techniques. However some of head and neck cancer (HNC) patients ended up with daily images. Our goal is to propose a method to identify HNC patients that should be included in a daily image on-line review protocol after the three first fractions.

Materials and Methods: HNC patients are immobilized by customized thermoplastic masks. Patients are first positioned by matching lasers to three marks on the mask. Then, kV-MV orthogonal images are taken and compared on-line with DRRs